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ABSTRACT

This guide is one of a set of 10 science guides, each covering a separate grade in Manitoba, together covering kindergarten through grade 9. The guides have been designed to provide a framework for building scientific concepts and developing the learning of process skills. They replace an earlier set of guides dated 1979. Each guide is essentially the same through the first 16 pages, after which the core units vary appropriately for each academic level. Three themes and units within those themes which are carried through the K-4 program include: (1) environmental interdependency and interaction--life cycles (grade 3); (2) matter and energy--energy, heat and temperature (grade 3); and (3) earth, time and space--sun, earth and moon/air and air pressure (grade 3). (AA)

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Manitoba
Education
and Training



1991

science: grade 3

interim guide

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science: grade 3

interim guide

THIS GUIDE IS SUBJECT TO REVISION ON THE BASIS OF INFORMATION RECEIVED FROM SCHOOLS. IT IS EXPECTED THAT MODIFICATIONS WILL NOT BE MADE IN THE DESIGN OF THE PROGRAM. RATHER, CHANGES MAY BE MADE IN AREAS CONCERNING STRATEGIES AND IMPLEMENTATION.

manitoba education and training

1991

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This guide has been prepared by Manitoba Education and Training to meet the needs of grade 3 students. This guide has been revised on the basis of feedback from teachers during the period of 1988-89. It has been designed to articulate with the new K-2 and 4-9 Science guides and to provide a framework for building scientific concepts and developing the learning of process skills. This guide may be used in September, 1991, in place of the previous (1979) guide.

The Department of Education and Training wishes to acknowledge the contributions of the following members who constituted the committees responsible for the development of this guide.

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Grade 3

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OBJECTIVES OF THE CURRICULUM

AIMS

"Science is a search for understanding" through a systematic and cumulative exploration of the natural phenomena of the universe.¹

Teachers should strive for balance in the science program, and should especially try to make processes development at least as important as content.

The K-4 science program includes the following:

- . promoting of attitudes as part of scientific literacy, including:
 - curiosity to explore, ask questions, actively investigate;
 - inventiveness in generating new ideas, using equipment constructively, suggesting new experiments;
 - critical thinking to justify conclusions or predictions and changing ideas in response to evidence or logical reasons;
 - persistence in maintaining an active interest in a problem.
- . understanding and use of scientific processes.
- . understanding and applying knowledge to practical situations.
- . understanding the interactions of science, technology and society by applying them to their environment.

¹ H. Grunau, Faculty of Education, University of Manitoba.

Science education provides experiences that are relevant to children on an immediate and personal level, developing attitudes, skills and knowledge for use today and in the future.

Exploration of the above areas, and helping children to apply the ideas in practical situations, provide for use of higher level thinking processes, which in turn provide for self-motivated, independent, concerned participants in society.

ROLE OF SCIENCE IN GENERAL EDUCATION

Children initially examine their environment through concrete experiences within a broad range of interests. One of the important functions science shares with other areas of study is the development of basic processes of classifying, measuring, using space-time relationships, inferring and predicting, and applying these processes to the world around them.

The young child lives in and views an integrated world and this leads to many opportunities for integrating subject areas.

Through interaction with materials in simple group activities, children are able to develop listening, reasoning, and group participation skills. In centre based activities, small groups and individuals develop written communication, graphing and measurement skills, independence and confidence. Children need opportunities to concretely explore and understand relationships in this multi-dimensional world. Science can "spark" interest in all areas of study. An example of the Kindergarten science concept "plants require certain things to grow" is outlined to show one way of integrating objectives from other subject areas i.e., the use of centres.

THE LEARNER

VARIETY AND NATURE OF CHILDREN

The emphasis of psychologists such as Piaget, Bruner, Ausubel, and Gagne is placed on experience with concrete materials and the child's need to be involved in actively structuring his or her learning. According to Piaget, children pass through an ordered series of developmental stages, believed to be controlled by the maturation of the brain and the nature of a child's experience. These stages aren't limiting, as all children have different experiences in different areas.

Appropriate activities for Piaget's various stages are:

2 to 6 years - Pre-Operational

Being able to manipulate and carry out physically the actions he/she may not be able to carry out mentally. Exploration and experiences of trying things out to see the result enables them to link cause and effect. An activity is repeated several times, if desirable.

7-12 years - Concrete Operational

Exploring a wide range of problems in real situations and gradually coming to see patterns. Planning and carrying out investigations or methods of problem solving which he/she has devised; discussing results and learning from errors about the variables which should be controlled. Putting problems in concrete terms where doing can support thinking.

13-15 years - Formal Operational

Drawing conclusions from previous learning and applying principles to new problems. Testing ideas by planning experiments which control all the necessary variables. Developing abstract ideas about properties of materials; devising and using theoretical models for predicting and explaining.

Taking this into account, the science program must be experience-based and activity-centered. Concrete experiences are essential for the pre-operational and concrete-operational stages in order to meet changing needs, abilities, interests and learning styles of the children. The science program must give children time, space, and encouragement to explore science and consolidate learning inside and outside the classroom.

MISCONCEPTIONS IN SCIENCE

Misconceptions represent complete systems of explanations which are conceptually wrong. They are usually personal and constructed from one's experiences. K-4 children harbour many misconceptions in science, partly due to their limited experiences and stage of mental development. These misconceptions may be adjusted by teaching science through a wide usage of concrete and relevant experiences, and adequate, appropriate discussions of findings in a non-threatening environment. Some examples of misconceptions are:

1. that an object will float in shallow water but will sink in deep water;

2. that because plants need sun, food and water, the plants will flourish if you give them direct 24 hour sunlight, and as much water and fertilizer as possible;
3. that the metamorphosis of mealworms will result in only more mealworms with the misconception expressed by the question: Who put the beetle in the bottle?

Teachers of science who want to modify their children's conceptual framework need to challenge the children's alternative conception. Some guidelines for teachers are:

- . ask children for their ideas, respect the ideas and explanation offered;
- . guide the students into developing experiments or experiences that will allow them to test their ideas;
- . encourage the children to discuss and resolve the discrepancies between their initial predictions and the new evidence;
- . always listen to see whether students have adjusted their conceptual framework after the experiment or experience.

GIRLS IN SCIENCE

Research shows that girls are biased against areas of physical science through home, media and school experiences at as early an age as six years. Girls have already developed opinions about appropriate

behaviours and occupations for one or the other sex by this age.

"A girl might aspire to be a lawyer but expect to be a typist in a law office; she might aspire to be a doctor but expect to be a nurse."²

Teachers must:

- . consciously model enthusiasm and involvement in science to motivate children to participate and become involved in science;
- . offer bias-free resources (those that give equal consideration to both sexes in career and life-style portrayal);
- . have equal expectations for boys and girls (studies have shown that boys receive considerably more teacher feedback, occupy more physical space, are more critical of girls and of each other, and generally assume the leadership role in a mixed group);
- . encourage both boys and girls in planning, recording, setting up experiments, using equipment and other learning opportunities;
- . encourage projects which recognize skills and interests of both sexes and discourage put-downers or devaluing of "female" interests by male students.

² "Who Turns the Wheel?", Science Council of Canada, January, 1982, p. 82.

THE TEACHING ENVIRONMENT

PROGRAM IMPLEMENTATION

The school administrators have an important leadership role in science program implementation. This role includes the following directions or activities:

- . encouraging a shared management of implementation for the science program by providing opportunities for cooperative planning.
- . monitoring the degree of implementation and the needs of staff.
- . determining the implications of the curriculum for staff training and facilities.
- . providing easy access to the materials and facilities needed for the program. This will include the provision of sufficient funds which would be used to purchase necessary equipment and materials as the need arises.

Some implications of the science program for implementation into the school include:

- . like in the previous curriculum, the new program emphasizes the development of science processes and concepts. The use of activities to develop these processes and concepts will affect teaching methodology and evaluation methods.
- . the K-4 science program has introduced new segments within the program: Flotation: A Property of Matter, life cycles, a consolidation of the previous K-1 program, application of science and

Implementation may require specific work with teachers in order to increase their knowledge and teaching methodology base for these units.

- . the science program suggests some ways to integrate some mathematical and language arts skills into the structure of some topics. Developing additional units whereby mathematics and language skills are an outcome of science units and activities may be required.

Evaluating the effectiveness of the science program consists of judging its worth on the basis of valid information about how well the achieved curriculum meets the objectives of the intended curriculum. Many sources of data should be searched to provide a basis for the evaluation, such as:

- . evaluation of student achievement;
- . analysis of the methods of evaluation;
- . teaching strategies and emphases upon program goals.

Additional sources of information about program evaluation are:

1. Mechling, Kenneth R., "Taking Charge: How Principals can Improve School Science Programs, "Principal, January 1983, pp. 16-21.
2. Mechling, Kenneth R. & Oliver, Donna L., "Activities, Not Textbooks: What Research Says About Science Programs.", Principal, March 1983, pp. 41-43.

3. Mechling, Kenneth R. and Donna L., Promoting Science Among Elementary Principals: Handbook I-IV, National Science Teachers' Association, 1742 Connecticut Avenue, N. W., Washington, D.C., 1983.

COMPUTERS IN SCIENCE

Computers are a recent addition to the learning environment. They offer extensions and support for science learnings. Computers are not a primary means of delivering science education or a replacement for direct investigations. However, they can enrich the science program and provide individual and practice work in a number of ways. These include:

- . developing an awareness of the role of complex technologies in society.

- . simulations;
- . problem solving exercises.

Computers are a way of life in the future for children.

TIME ALLOTMENT FOR THE SCIENCE PROGRAM

Recommended time allotments for K-3 science are 15 minutes daily or 75 minutes weekly and for grades 4-6 are 30 minutes daily or 150 minutes weekly. Time allocations for each unit can vary but teachers should ensure that students are given sufficient time to cover the entire program for any given year.

ENRICHMENT ACTIVITIES

The activities included in the K-4 program provide learning experiences that help students understand and interpret the world in which they live. The activities which appear under the heading of enrichment are intended as extensions to the regular program. These activities have been selected in order to allow students to explore some areas at greater depth.

EVALUATION

STUDENT EVALUATION

The general purposes of student evaluation are to provide:

- . students with an understanding of their development and needs relative to the program;
- . teachers with a basis for planning necessary changes in teaching strategies and the curriculum;
- . information for parents and administrators.

Thus, evaluation should be related to program objectives, and in the K-4 science program, it should relate to science processes and attitudes in addition to content. Further, evaluation must be continuous and use a variety of approaches.

Informal observation techniques whereby teachers observe individual and group interactions in an activity can help to determine needed skill development of students and techniques which can be used to improve their skills.

Formal techniques include achievement and performance tests, checklists of processes, attitudes, and manipulative skills and the examination of products such as reports or projects. Although achievement tests (pencil and paper variety) are generally considered to evaluate content most effectively, other objectives of the program such as science processes and attitudes can be evaluated by written and performance items, checklists and other means.

SAMPLE EVALUATION TECHNIQUES

A. Processes Checklist

Monitoring student achievement in science processes may be helped by observing student behaviours in applying the processes. The student should be able to carry out the processes noted in the objectives in each science unit in the curriculum, at the appropriate grade level. A checklist from these objectives can be made, the concepts are taught, and then the process involved can be checked off for those students who show mastery. Samples of some student behaviours are:

<u>Process</u>	<u>Behaviour</u>
Observing	. Identifies properties of an object with and without sight; uses a variety of senses. . Selects objects according to special properties. . Identifies changes in an object and parts of a system. . Places a greater emphasis upon quantitative observation (estimating, measuring). . Describes motion of an object relative to a reference point.

- Communicating
- . Reads and constructs bar graphs, simple tables, and charts.
 - . Interprets accurately information and instructions presented orally, in writing, and in graphic or pictorial form.
 - . Reports information concerning an investigation; e.g., states the problem, records the results, and reaches a conclusion.

B. Scientific Attitude Checklist

<u>Attitude</u>	<u>Behaviour</u>
Questioning of All Things	. Shows curiosity with objectivity and open mindedness.
Searching for Data and Their Interpretation	. Looks for support for their ideas.
Demanding Verification	. Seeks data and information to validate observations or explanations. . Questions conclusion based on incomplete data.
Respecting Logic	. Modifies views in the face of new evidence . Shows respect for the ideas of others.

C. Performance Items

These items may be used individually or in a group (station) setting to test process and manipulative skills at the grade 3 level. For example:

Birds

Purpose: to test observing/classifying, interpreting skills.

Procedure: Pictures of two birds are provided and children are asked to see what is different about them and how they are different. Use only observable differences, i.e. colour/pattern, size/shape, environment.

Marbles in Tubes

Purpose: to test observing, inferring, interpreting data, explaining physical phenomena, safety/manipulative skills.

Procedure: Three covered tubes in upright positions, each containing liquids of different densities (i.e., water, vegetable oil, methyl alcohol) and a marble. Tell students that the marbles are all the same size and weight. Have students examine the tubes and turn them upside down. Ask students to write down three things they observe and to propose a reason for the marbles taking different times to fall.

SAFETY AND SCIENCE^{3,4}

The K-4 curriculum contains few safety hazards to children. Teachers should establish proper classroom behaviour, conducive to safe operation. Common sense is the best guide to follow in the area of safety. Manageable group size and a well-planned lesson will allow students to work without confusion. By showing concern for safety, the teacher can help the students develop a positive attitude in regard to safety.

General Safety Guidelines

- . At the beginning of the science class, remind the students about the applicable safety precautions they must take during the lesson.
- . Give clear, complete directions before allowing the students to begin any activity.
- . Instruct students not to taste or touch substances or materials without permission.
- . Stress the importance of not touching one's eyes, ears and mouth while working with plants, animals and chemicals.
- . Allow time for clean-up and proper storage of materials.
- . Closely supervise your students at all times.
- . Familiarize students with first aid, fire drill and other emergency procedures.

³ "Safety in Science." Department of Education, 1982.

⁴ "Safety in the Elementary Science Classroom," National Science Teachers' Association, 1742 Connecticut Avenue, N.W., Washington, D.C., 20009.

Some tips on animals and plants are:

Animals

- . Check for student allergies.
- . Obtain animals only from a reputable dealer.
- . Keep in suitably sized enclosures.
- . If animal is in poor health, remove it from the room until a veterinarian has been consulted.
- . Always wash hands after handling the animal.
- . Keep an animal only for as long as it is a meaningful part of a classroom program.

Plants

- . Check for student allergies.
- . Be aware that parts of some plants are poisonous, i.e. leaves - rhubarb, dieffenbachia;
sap - poinsetta.
seeds - castor beans

ATTITUDES AND SKILLS

ATTITUDES AND VALUES

One of the greatest achievements of science is to have developed scientific methods that work almost independently of the people who are conducting the scientific investigations. Thus, children learning science must also learn many attitudes toward science such as:

- . objectivity;
- . open-mindedness;
- . fairness;
- . accuracy;
- . thoroughness;
- . perseverance;
- . curiosity;
- . creativity;
- . risk taking.

The rudiments of these scientific attitudes can be learned very early in school, based on a gradual understanding, rather than direct teaching.

SCIENCE, TECHNOLOGY AND SOCIETY

School science is sometimes understood by students to be an end in itself. A science, technology and society (STS) emphasis attempts to help students understand the applications of science and how this relates to the world around them, making science much more relevant.

For the K-4 level, the major STS emphasis is the child's home, community environment; expanding to include cities, provinces and beyond.

The methods for incorporating STS are varied. One approach is to develop a science concept first, followed by applications, i.e. introduce the concept of heat insulators and later apply the concept by testing house insulation or designing ice-cube insulators. Another approach is to introduce the application first, and conclude with the basic science concept, i.e., Discuss how we keep our house warm in winter, or why do people replace old windows. This is the application of the science first and through testing materials, the students will conclude with the basic concepts of insulators.

Overall, it is suggested that STS goals should receive some 15-20% of the total emphasis. Some units and/or parts of units in the curriculum lend themselves more to STS activities and discussion than others. This guide marks some STS objectives/activities with two asterisks (**) beside it. Teachers should feel free to find or develop their own examples.

ENVIRONMENTAL EDUCATION

Concerns for the environment have become so important that teachers need to be aware of imparting these values to children by example as well as by formal teaching. Such environmental values include:

- . responsibility for living organisms;
- . consideration for others;
- . interaction with the environment in a responsible manner;
- . concern and care for the environment.

Values taught through science education transfer well to life outside the classroom, developing environmentally alert individuals capable of making well-reasoned interpretations and motivated to taking responsibility for their decisions throughout life.

SUSTAINABLE DEVELOPMENT STRATEGIES

Sustainable development is the process of maintaining our natural heritage. It is important that students are made aware of the need for judicious use and management of our natural resources. The students are the stakeholders. They need to be informed about environmental concerns and the economic devastation which occurs due to a lack of environmental protection.

A Sustainable development strategies (SDS) emphasis in the science program will allow students to identify the areas in which environmental damage is taking place and to explore methods by which the environment can be protected. This SDS emphasis begins in kindergarten and continues throughout the entire science curriculum.

Some units lend themselves more to SDS activities and discussions than others. Teachers are encouraged to develop and foster SDS awareness whenever the opportunity arises.

This guide identifies the SDS related objectives with three asterisks(***) beside them.

PROCESS DEVELOPMENT

Processes are intellectual skills, developed and used both in science and other areas of study. When children experiment with materials and examine ideas both processes and concepts are being developed and used. Observation and classification skills are important to the development of more complex processes such as interpreting data and are therefore classified as basic processes. These basic processes should begin to develop from early experiences. Experimenting and controlling variables are termed integrated processes and can usually be more effectively learned by children in the late concrete and formal operational states. Each process, in turn, consists of a series of levels of difficulty, i.e., the process of observation varies from the skill of describing an object in terms of a single property to identifying the object in terms of its many properties. The basic processes are gradually developed from early childhood through grade four. The integrated processes are stressed at higher levels, but all processes can be informally introduced to young children through simple investigative situations presented and directed by the teacher.

It should be noted that many of the main processes often include other activities that reflect various aspects of the process:

- . observing includes identifying;
- . classifying includes comparing and ordering;
- . communicating includes describing and graphing.

Observation

Observing is one of the basic process skills of science. It involves obtaining information about objects, situations or events using the five senses. Observation may be qualitative or quantitative in nature. Observing provides both a basis for new inferences or hypotheses and a tool for testing existing inferences and hypotheses.

Measurement

Measuring is the process of determining the dimensions or quantity of an object or event. It usually involves comparison of size, volume, mass, temperature and time using non-standard/standard units.

Classifying

This process is the grouping of objects, concepts, or events on the basis of some observable properties in order to show similarities and/or interrelationships.

Inferring

Inferring means suggesting more about a set of conditions than is observed. Inferences are based upon observed data and past experience. Inferences may evolve from both direct and indirect evidence and are modified on the basis of new evidence. An example of inference: "to infer the identity of objects on the basis of observation of shadows".

Communicating Data

This is a process that occurs between the observation stage and the interpretation stage. It usually involves -the organization of "rough" data into a more compact and meaningful way (ordering, comparing), depicting the data pictorially or graphically, and processing data mathematically (averaging, finding slopes) in order to facilitate interpretations.

Predicting

Predicting is a forecast about future events based on previously obtained data. Predictions can be made on the basis of ordered data or extrapolation beyond an observed pattern of events. An example of prediction: "to predict the consequences of changes in an animal habitat".

Hypothesizing

Hypothesizing is an educated guess about an expected relationship between two variables in an attempt to explain a cause and effect relationship. The hypothesis should be testable.

Recognizing and Identifying a Problem

This process involves recognizing and focusing on a problem that can be investigated, making assumptions about possible variables, and the ability to narrow down the question under investigation in order to work towards a solution.

Identifying and Controlling Variables

This process involves deciding which variables will influence the outcome of an experiment or event and deliberately controlling all recognized variables in a systematic manner. This combination of relationships (system) consists of a manipulated (independent) variable which is changed in a systematic way, corresponding changes in an observed responding (dependent) variable and all other variables are held constant (controlled). An example is a pendulum system where the time of swing (responding) is affected by the pendulum length (manipulated) and other variables such as mass of the bob and arc of the swing are kept constant.

Designing an Experiment

Experimenting is a cause and effect test between two variables. All processes may be involved. This may begin with setting a problem to be solved identifying a variable to be controlled, making operational definitions, devising the test to be carried out and finally to follow the prescribed procedure.

Interpreting Data

Interpreting is the process by which sense is made out of the observations in the form of inferences, generalizations or explanations. Thus, selecting data which supports inferences, identifying a general trend, and stating a conclusion or relationship are integral parts of this process. An example is: "state the average growth rate of bean plants."

Operationally Define

This is a process whereby objects or events are defined in a way which can be tested or observed such as: "When I join copper wires, a bulb and a dry cell in this way, a bulb will light up."

Using Space/Time Relationship

All objects occupy points in space at a given point in time. This process concerns spatial relationships and the ability to describe such things as shape, symmetry, direction, position and spatial arrangement, and speed.

PROBLEM SOLVING

Problem solving is a familiar teaching/learning approach which lends itself to science teaching. Problem solving includes:

- . recognizing problems;
- . discussing or thinking about solving them;
- . trying out one solution;
- . assessing the effectiveness of the solution;
- . possibly modifying the solution in the light of experience.

The approach can be used to help children understand the world of human endeavours through practical problem-solving activities, involving using and discovering science skills in conjunction with "design and make" activities.

Problem solving exercises can vary considerably in content and in the processes and strategies ~~em-~~ployed:

- . exercises which are of a technological nature where children are asked to design, construct, test and evaluate a system;
- . exercises designed to carry out a scientific investigation;
- . decision making exercises where children discuss a problem and come up with their own solution (role playing, games, simulations).

Preferences should be given to activities that involve a problem-solving approach and which:

- . encourage creativity and inventiveness in designing and making 3-dimensional models which achieve a given task;
- . cause students to learn or reinforce concepts relating to energy, materials and their properties, structures, forces, speed, measurement, accuracy, stability and control;
- . give opportunities to develop manipulative skills with simple tools and range of materials;
- . develop communication skills within and between teams and adults including drawing and display of ideas and achievements;
- . involve some element of planning and organization.

Problem solving should be a regular part of the science program. This guide marks problem-solving objectives/activities with one asterisk (*) beside it.

SCOPE AND SEQUENCE

Process Development: When a process is introduced at an early stage, it should be developed and maintained in subsequent years.

PROCESS/GRADE	K	1	2	3	4
Observing	I	D	D	E	E
Measuring	I	I	D	D	E
Classifying	I	I	D	E	E
Inferring	I	I	D	E	E
Communicating	I	I	D	D	E
Predicting	I	I	D	D	E
Recognizing a Problem	I	I	D	D	E
Controlling Variables			I	I	D
Hypothesizing				I	D
Interpreting Data			I	I	D
Operationally Define			I	D	D
Design Experiments			I	I	I

Note:

- I - Introduce processes using primarily teacher input.
- D - Develop processes with less teacher input.
- E - Extend processes to become more student controlled and directed.

ATTITUDE DEVELOPMENT

When an attitude is introduced at an early stage, it should be developed and maintained in subsequent years.

ATTITUDE/GRADE	INTRODUCTORY GRADE
Appreciate all living things.	K
Be committed to good animal care.	1
Be aware that animals can cause allergic reactions.	1
Value differences and similarities among humans.	1
Appreciate the adaptive value of some animal behaviours.	3
Recognize the need for safety in all activities.	K
Recognize the need for standard units and references.	1
Appreciate the need for verification.	1
Develop curiosity about natural events.	2
Recognize the need for accuracy in measuring.	2
Recognize that predictions can be made as a basis of valid evidence.	2
Seek plausible hypotheses to interpret findings.	4
Recognize the need for an empirical test as a basis for judging hypotheses.	4
Respect the importance, order, and beauty of the environment.	2
Recognize the need for man's care of the environment.	2
Recognize the importance of uses of different energy sources.	3
Develop an interest in learning about the universe.	3
Recognize the need to control sound in the environment.	4
Appreciate the technology of communication.	4
Appreciate the technology of electricity.	4
Appreciate the power of geological forces.	4
Recognize the dependence of man upon geological forces.	4
Recognize the importance of water as a resource.	4
Recognize the need to control and handle water wisely.	4

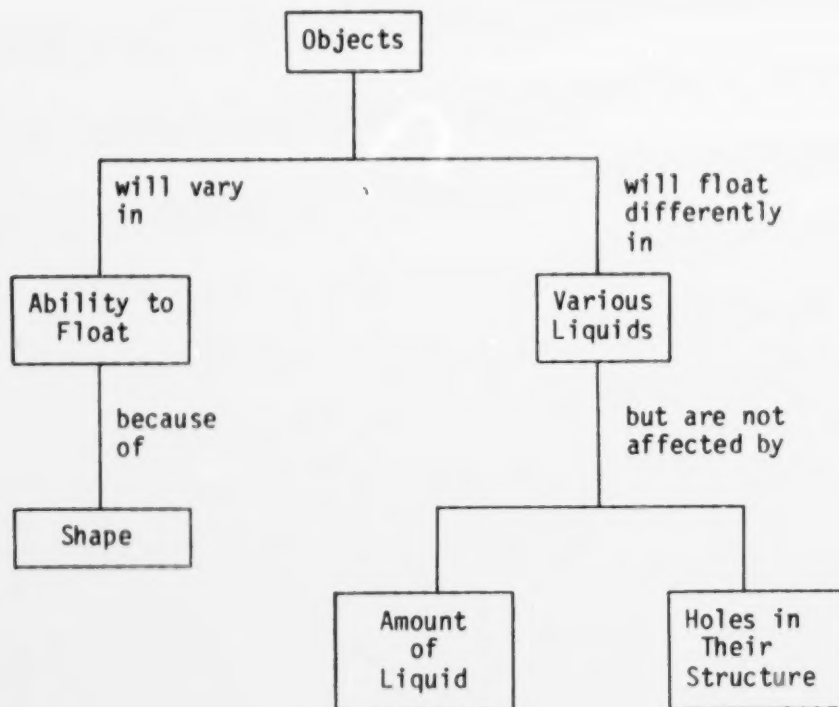
General Program Overview

THEME	K	1	2	3	4
Inter-Dependency and Interaction	Living and Non-Living Organisms	Animals are Living Organisms ----- People are Living Organisms	Living Organisms in the Environment	Life Cycles	Population Interaction
Matter and Energy	Properties of Objects	Properties of Matter	Flotation: A Property of Matter	Energy, Heat and Temperature ----- Changes in Matter	Electricity ----- Structures ----- Sound
Earth, Time and Space	Size, Position and Time	Comparing and Measuring Events	Light and Shadows ----- Measuring Time, Objects and Position	Sun, Earth and Moon ----- Air and Air Pressure	Water and Land

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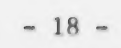
GRADE TWO

CHANGES IN MATTER AND ENERGY: FLOTATION: A PROPERTY OF MATTER



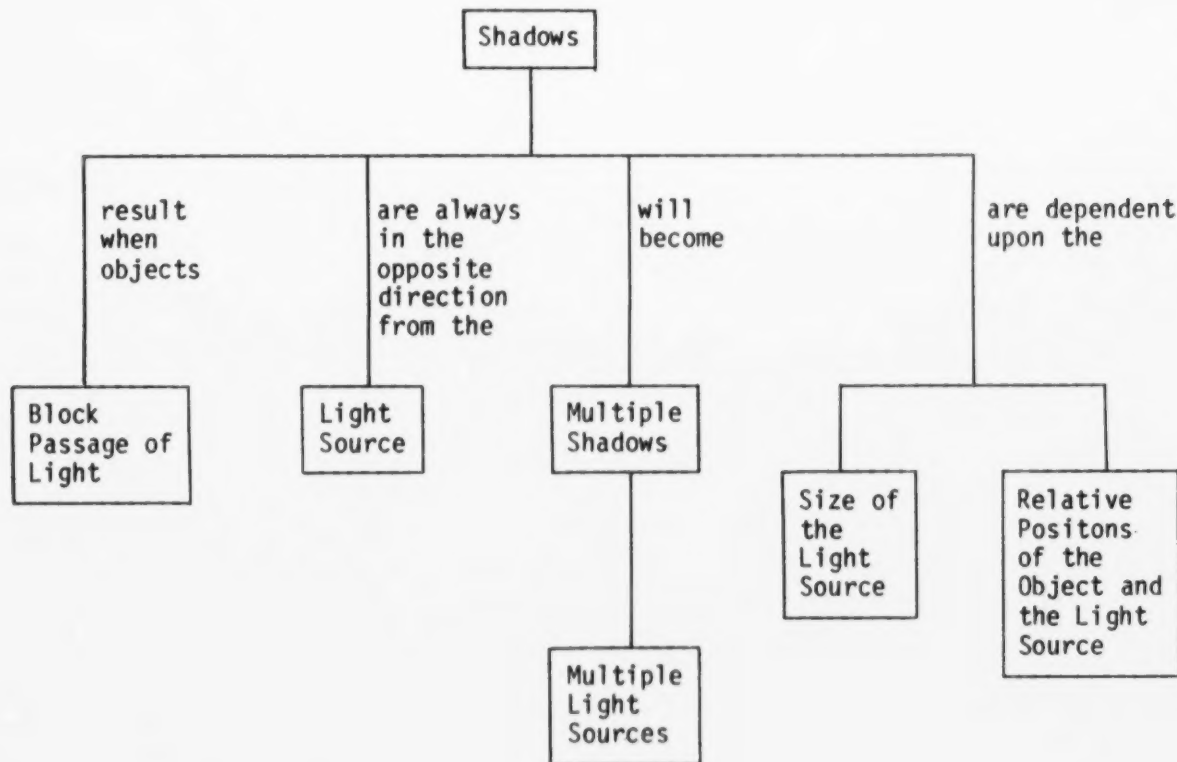
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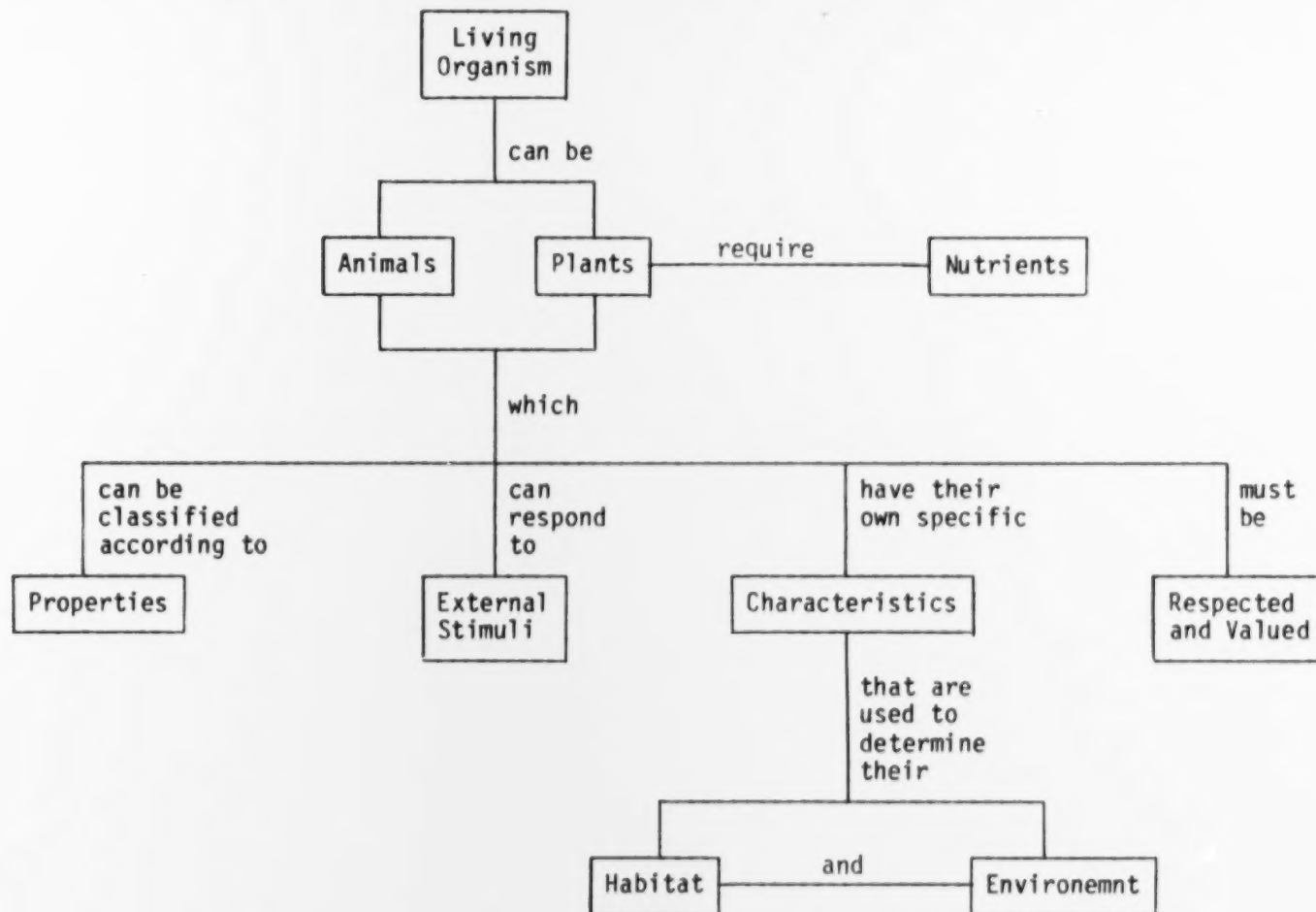


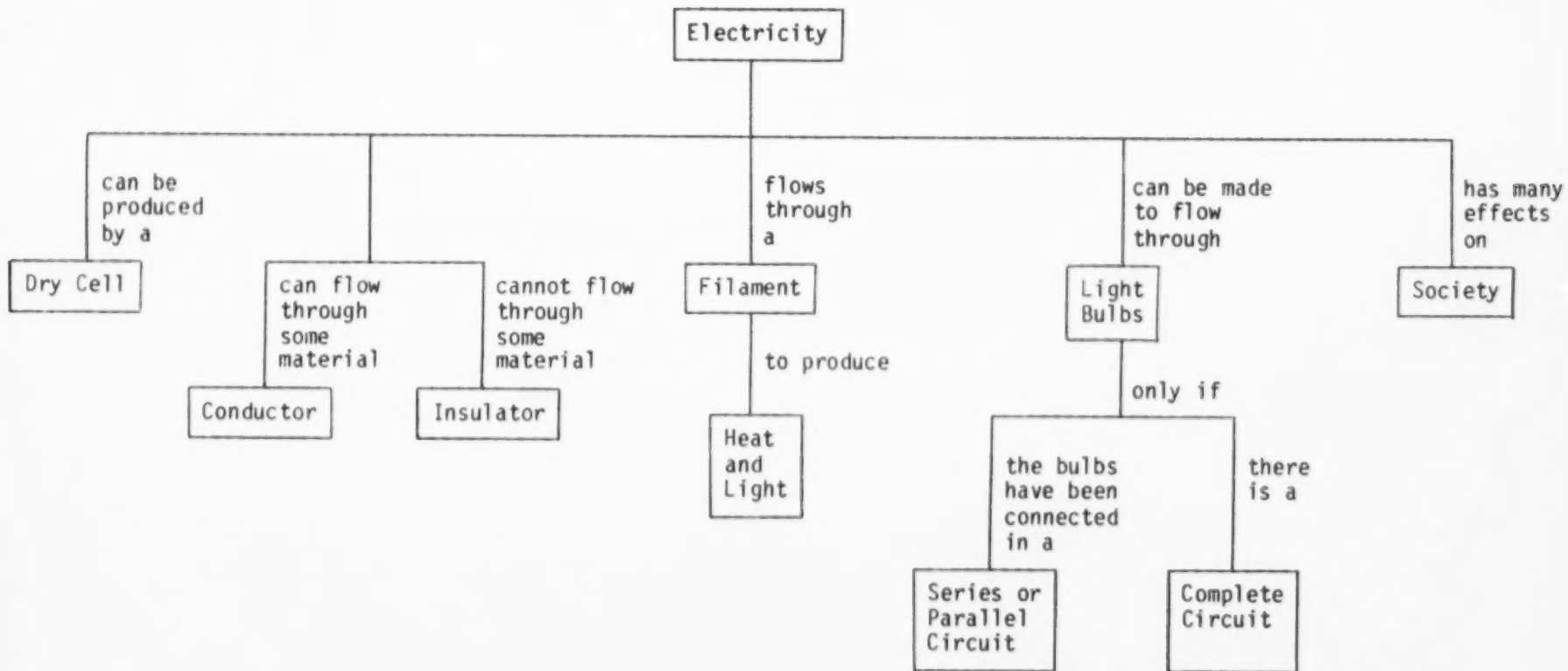
GRADE TWO

EARTH, SPACE AND TIME: LIGHT AND SHADOWS



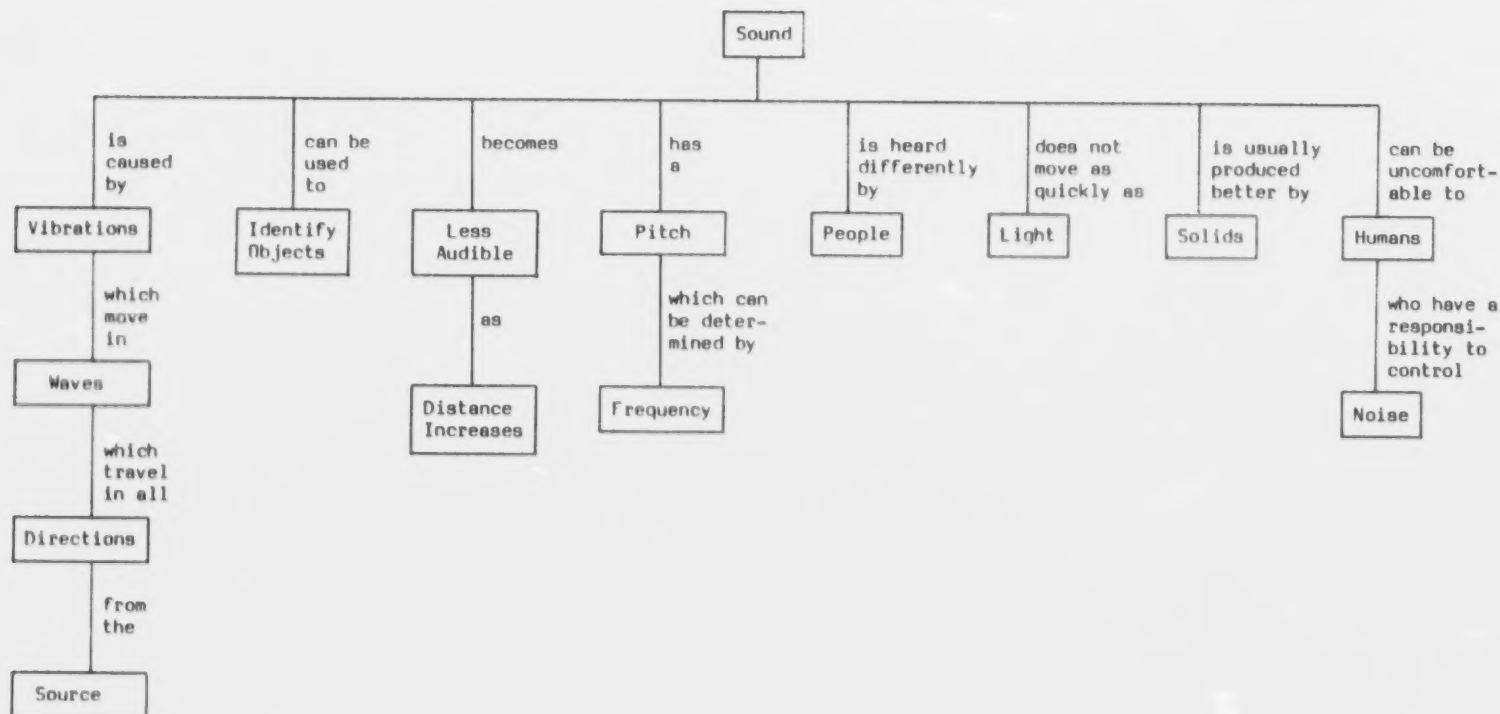
INTERDEPENDENCY AND INTERACTION AMONG ORGANISMS: LIVING ORGANISMS IN THE ENVIRONMENT





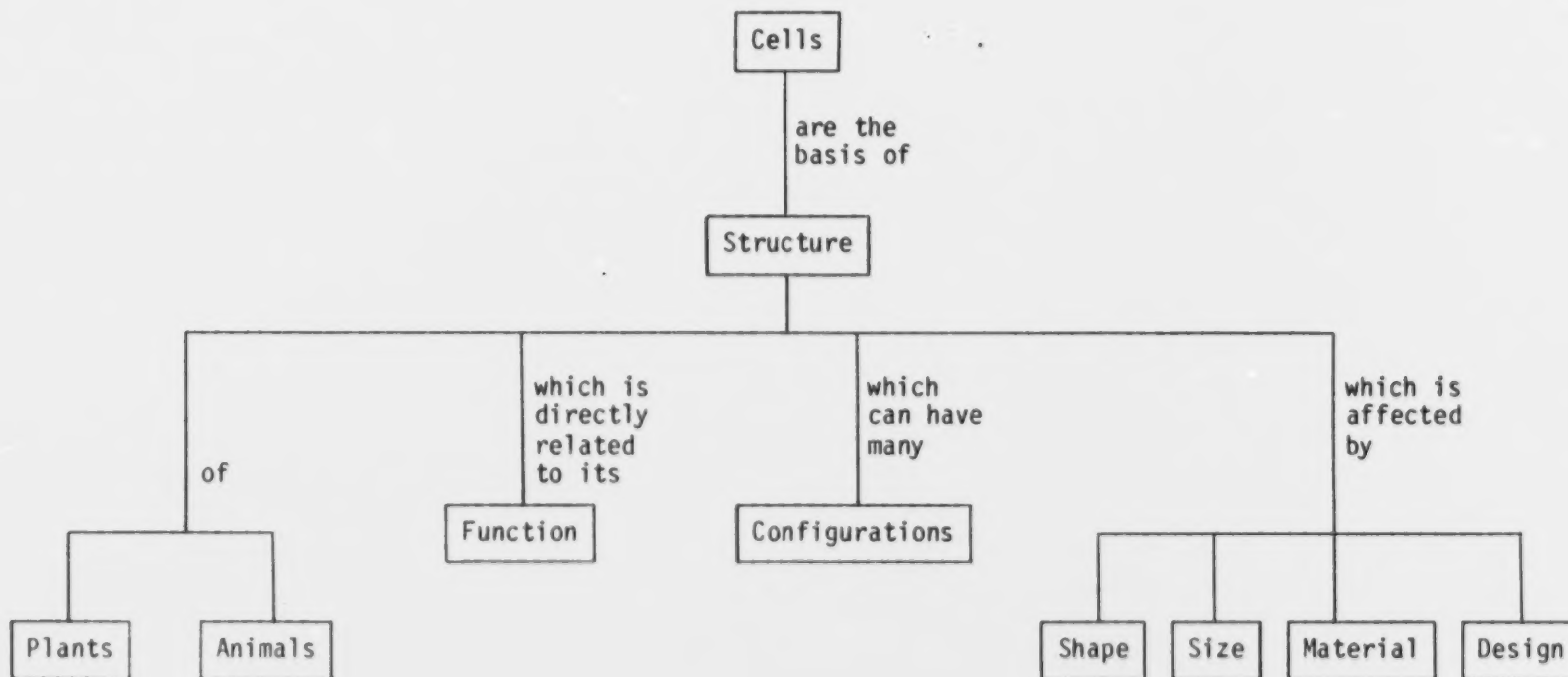
GRADE FOUR

CHANGES IN MATTER AND ENERGY: SOUND



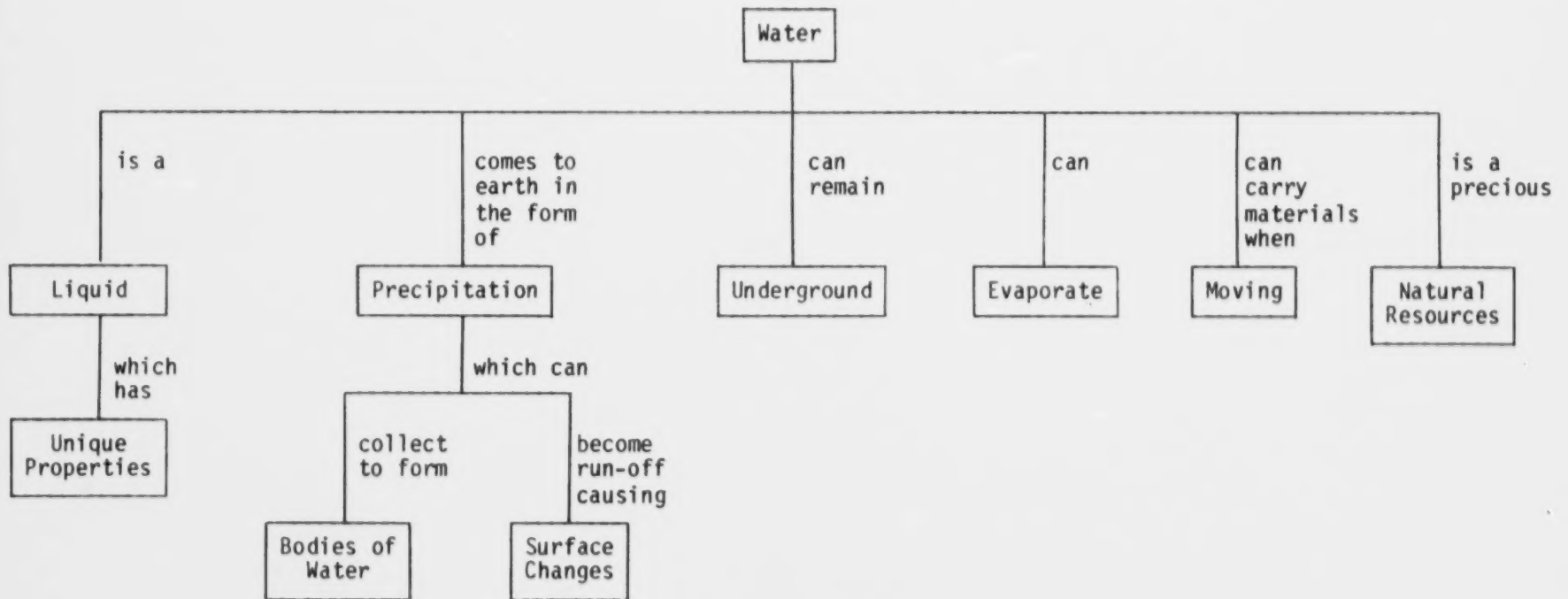
GRADE FOUR

CHANGES IN MATTER AND ENERGY: STRUCTURES AND FUNCTIONS

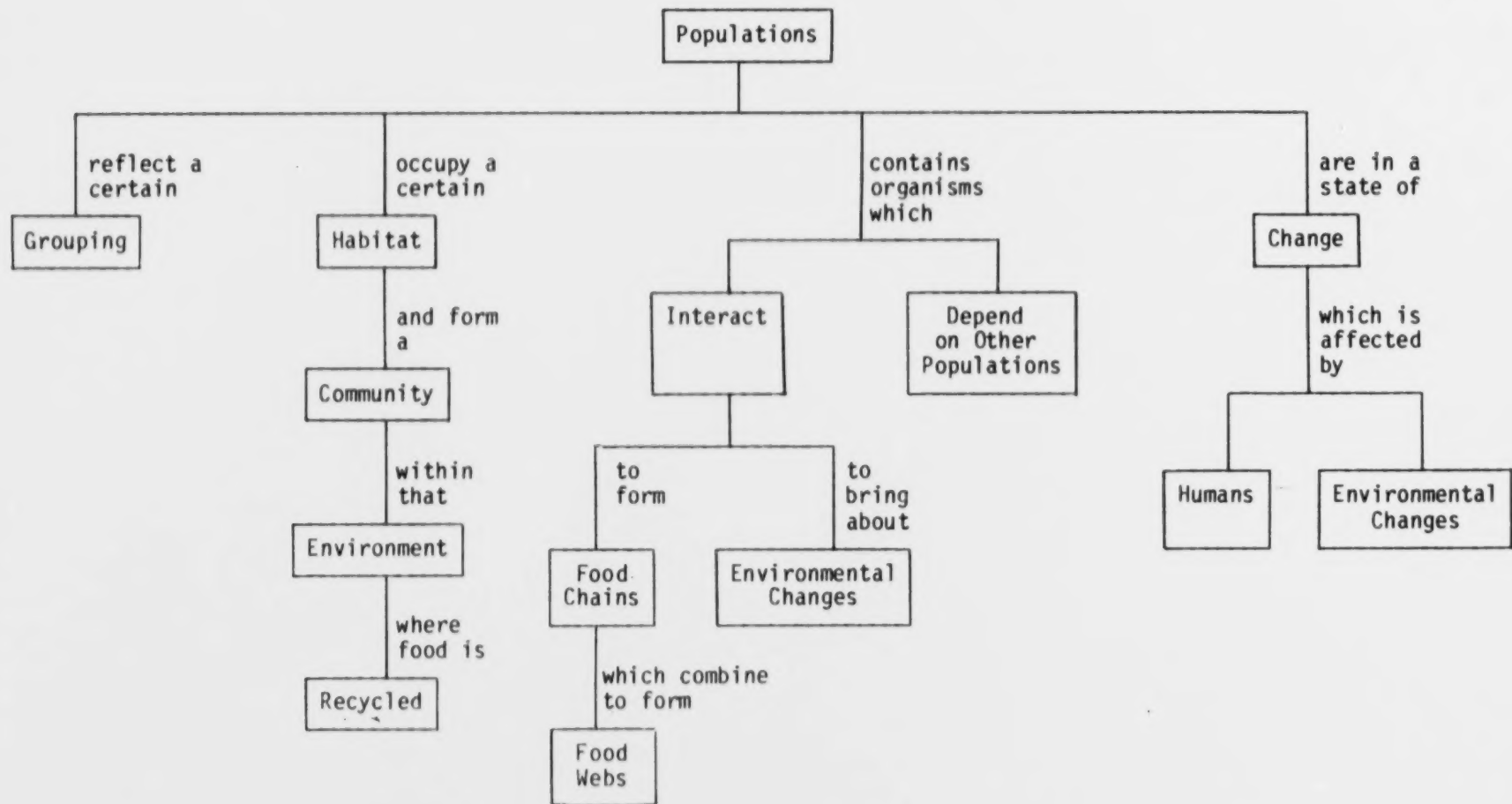


GRADE FOUR

EARTH, SPACE AND TIME: WATER AND LAND



INTERDEPENDENCY AND INTERACTION AMONG ORGANISMS: POPULATION INTERACTIONS



MATERIALS LIST

This is a suggested minimum list for the K-4 Science program. Many other items should be readily available at school or in the home. Teachers should be advised to review the units so that locally available material may be obtained in advance. A petty cash fund needs to be available in order that purchases may be made on an ongoing basis.

Basic Materials

- pop bottles (glass)
(plastic - 500 ml, 1 litre, 2 litre)
- plastic containers and lids in all sizes
- egg cartons
- trays of assorted sizes
- cloth of all textures, colors, and materials
- nylons and panty hose
- newspaper
- jars of all sizes with lids
- tin cans of all sizes
- pine cones, bark, twigs
- popcorn kernels
- food colouring
- a variety of woods
- a variety of sandpaper
- coins
- milk cartons
- alka seltzer tablets
- sponges
- assortment of food and cooking items
- crackers, orange juice crystals, detergent, spaghetti, macaroni, salt, sugar, sugar cubes, baking powder, vinegar, flour, syrup, corn-starch, vegetable oil, molasses, dish detergent.

- popsicle sticks
- large and small graph paper
- wax (paraffin wax)
- vegetable oil, molasses, dish detergent
- an assortment of string
- an assortment of wool
- waxed paper
- aluminum foil
- plastic wrap
- paper towels
- kettle
- pie plates styrofoam and tin
- insulated wire (copper)
- toilet rolls
- gravel
- sand
- ping pong balls
- cardboard of all sizes and thickness
- plastic combs
- tooth picks
- cereals
- cotton balls
- threads
- an assortment of nails
- fossils (plastic models can be purchased)
- pulleys single and double
- index cards
- pictures
- balloons
- latex gloves
- straws
- spoons
- elastic bands
- thumbtacks
- paper clips

- straight pins
- candles
- dry cells
- light bulbs (miniature)
- scale (kg)
- magnets
- magnifying glasses
- fixed pan balance
- aquarium
- variety of seeds
- plasticine
- meter stick
- tape
- tape measure
- weights (g)
- graduated cylinder
- beakers
- medicine droppers
- test-tubes
- thermometers
- rubber stoppers
- corks
- glass tubing
- filter paper
- marbles
- baggies
- paper towels
- mirrors
- steel wool
- washers
- styrofoam cups
- paper cups
- clock (with second hand)
- markers
- drinking straws

SPECIFIC MATERIALS

Kindergarten

1. attribute blocks
2. terrarium
3. bulbs (for planting)
4. soil

Grade One

1. attribute blocks
2. logic sets (trees, vehicles, etc.)
3. egg beater
4. metronome (if available)
5. graph paper
6. bathroom scale

Grade Two

1. graph paper
2. 30 cm. ruler
3. flashlights (different sizes)
4. light bulb and socket
5. chart paper

Grade Three

1. light bulb and socket
2. ball and ring apparatus
3. rubber tubing
4. meal worms
5. beetles
6. earthworms
7. glass flask
8. wax (paraffin)

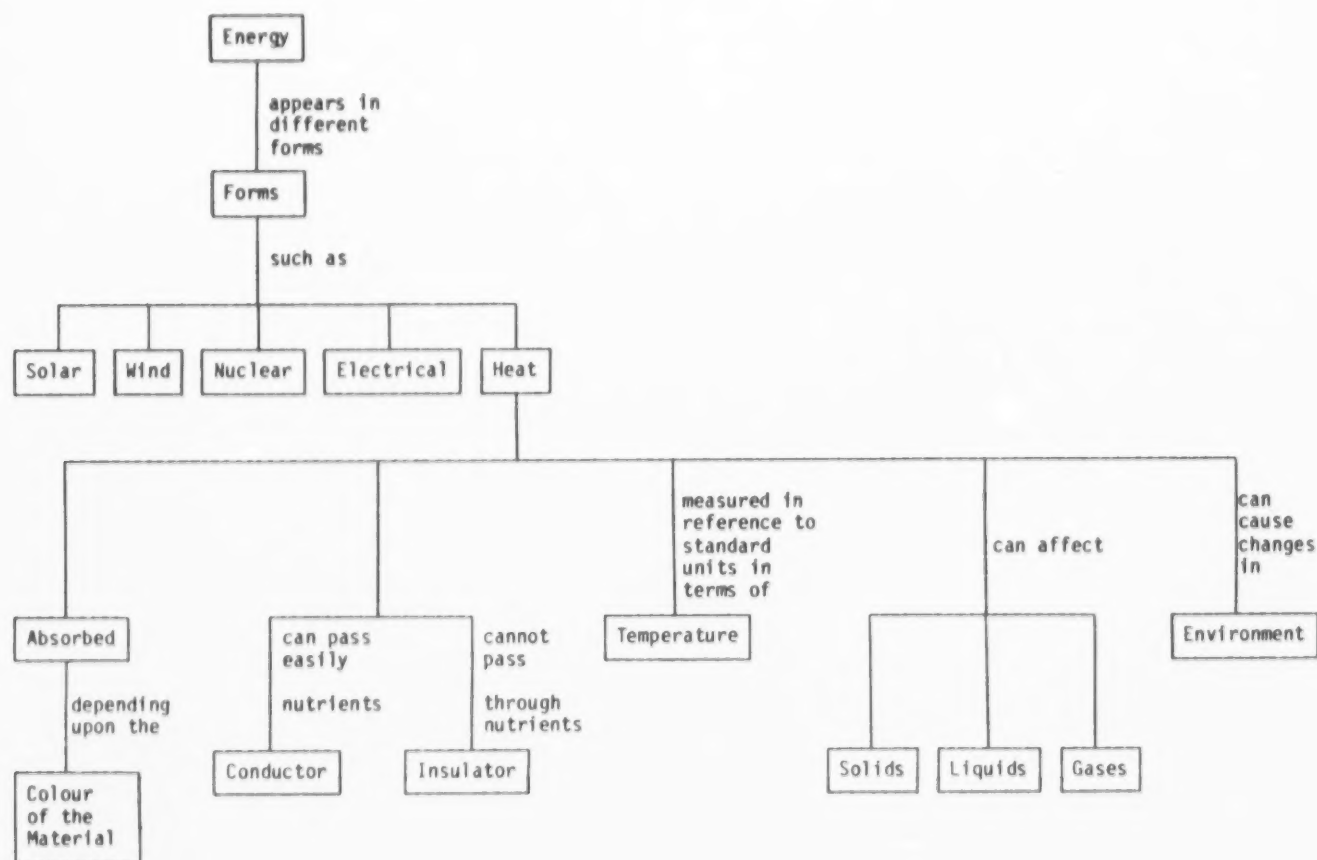
Grade Four

1. nichrome wire
2. sockets (for miniature light bulbs)
3. alligator clips
4. fine steel wool
5. tuning fork
6. slinky
7. ticking clock
8. microscope slides
9. cover slips
10. microscope
11. prepared animal cells
12. iodine
13. skeleton set

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GRADE THREE

CHANGES IN MATTER AND ENERGY: ENERGY, HEAT, TEMPERATURE



GRADE THREE

TITLE: CHANGES IN MATTER AND ENERGY: ENERGY, HEAT, TEMPERATURE

RATIONALE: Through the use of process skills, children will begin to recognize that energy is used in daily activities. Children will recognize that heat energy produces changes in matter and will begin to develop an understanding of standardized temperature units.

MAIN CONCEPT(S): 1. Heat is a form of energy.
2. Heat can produce changes in the properties of matter.

- * Refers to problem solving
- ** Refers to STS
- *** Refers to SDS

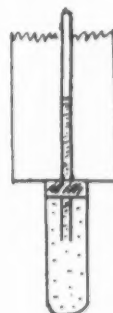
CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	The student should be able to:	
1. There are different forms of energy, for example: . heat . solar . wind . nuclear . electrical	a) <u>Observe and describe</u> different kinds of energy and the interactions which have produced motion. b) <u>Record</u> different types of energy.	<u>ENRICHMENT</u> Investigate other forms of energy. For example, magnetic, tidal, and chemical. Discuss why some people who don't eat breakfast feel tired.
	c) <u>Describe</u> how these types of energy are used in our environment.**	

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	d) List renewable energy resources.***	Explain that renewable energy sources produce energy without a loss of the resource i.e. water cycle.
	e) <u>List</u> daily activities that require energy and where the energy comes from.	Make a collage of types of energy and their sources.
	f) Identify the need for different energy sources.**	
i) Heat is one form of energy.	a) <u>Identify</u> heat as a form of energy.	<u>SAFETY</u> Be aware of safe practices in the use of heat.
	b) <u>Infer</u> that heat can cause motion.*	Make something that will move when heated. Try to make it move as quickly as possible.
		Make a tin foil spiral and hand it over a light bulb <u>or</u> construct an inverted bag balance, using a light bulb as the heat source.
2. Heat can affect solids, liquids and gases.		
i) solids expand when heated and contract when cooled.	a) <u>Observe</u> that solids expand when heat is applied and contract when heat is removed.	For example: demonstrate a ball and ring apparatus, a coil in thermostat, plastic vs metal container tops.
ii) gases.	a) <u>Infer</u> that heat gain causes expansion and loss of heat causes contraction in a gas.	Assemble two soda pop bottles. Put a balloon over the mouth of each bottle. Place one bottle in hot water and one in cold water. The balloon on the warmed bottle will expand.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
		**Discuss the changes in car tires in winter. On a cold day go outdoors. Place some colored H₂O in an aluminum pie plate. Invert an empty flask into the colored H₂O. Watch the liquid rise into the flask as the gas contracts. Carefully take the flask and pie plate indoors. Watch the liquid leave the flask as the gas expands. (Freezer of a fridge could be used). Place pop bottles in the fridge until very cool (10-15 minutes). Put a few drops of water on the rim of the bottle with an eye-dropper. Cover the mouth with a dime. The dime will "dance" in a minute or so. It is being pushed up as the air in the bottle warms up and expands. Use 2 thermometers--place one in hot water and one in cold. Watch the "heated" one rise due to expansion. <u>SAFETY</u> Do not use mercury filled (silver) thermometers. If broken, even a tiny amount of mercury can be hazardous.
iii) liquids	a) <u>Observe</u> and <u>infer</u> that heat causes expansion and removal of heat causes contraction in a liquid.	

- b) Observe the expansion of water.

Make a water thermometer.



cardboard to record water height

glass tubing

cork (or rubber stopper)

coloured water or alcohol in glass container filled right to cork

Place in fridge and mark height of water in tubing. Place between hands or on register and mark height of water in tubing.

- c) Predict and record the effect of heat on different liquids.

iv) Heat causing expansion and contraction changes in our environment.

- a) List applications of this process that we see in the environment.**

Research ways that we build sidewalks, roads, bridges, railroads and pipelines, to allow for expansion and contraction.

3. Temperature is the degree of hotness or coldness of an object with reference to some standard unit.

- a) Demonstrate a water thermometer made with two different sized tubes in the same water.

Predict and observe the effect of different thicknesses (diameter) of tubes.

SAFETY Use precaution when setting up scientific apparatus. Glass tubing is very fragile.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	b) <u>Infer</u> that a standard unit must be used so it reads accurately.	Discuss with the students that the thermometer is not very accurate if a standard unit is not used. e.g. scale has points on it which are equally spaced and read as degrees.
4. Temperature is measured in degrees.	a) <u>Observe</u> that 2 different standard thermometers measure the same temperature.	Give the students practice in reading thermometers. Using a lab thermometer and a basic outdoor or indoor thermometer find the temperature of the room.
		<u>ENRICHMENT</u>
		Research different standard units that are used in the world.
	b) <u>Observe</u> the calibration of a thermometer.	Demonstrate the location of boiling and freezing points of water, room temperature and body temperature. Note how the points on the scale are divided (by fives or tens, etc.).
5. Heat passes through some materials easily (conductors). Other materials do not conduct heat easily (insulators).	a) <u>Predict</u> and <u>test</u> the best type of insulator for an ice cube.	Place ice cubes in foil, paper, wood and styrofoam and see which lasts the longest.
	b) <u>Infer</u> that materials vary in their ability to conduct heat.	Place one end of each of these in hot water and determine by feeling which one conducts heat: . Metal can . Glass . Plastic . Wood . Paper cup . Styrofoam

CONCEPTUAL STRUCTURE

OBJECTIVES

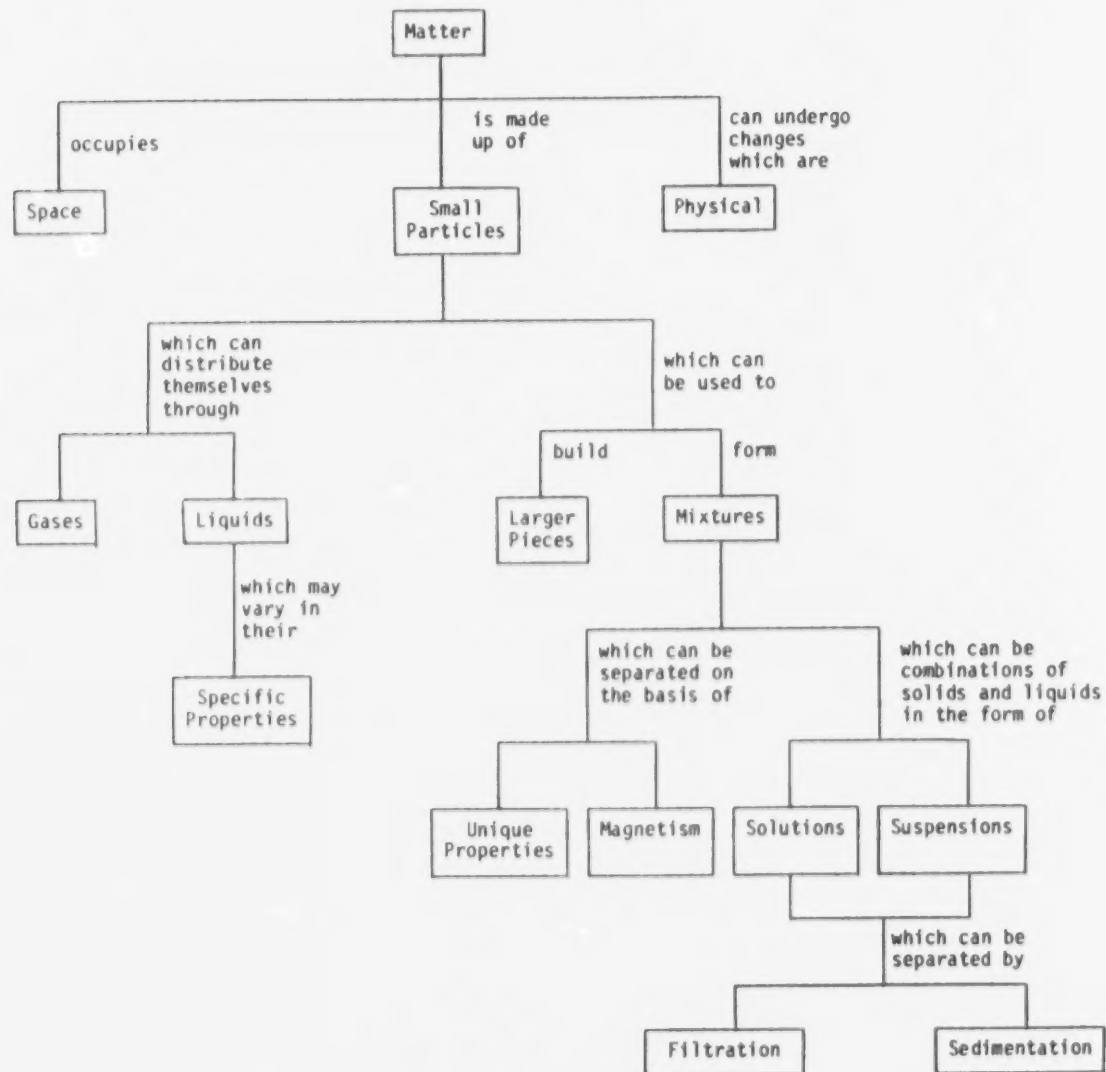
ACTIVITIES, REFERENCES

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|--|---|
| | Place a blob of wax on the end of a glass rod, a straw, a pencil, and a nail. Place the four items in a tin of hot water, making certain that the wax does not touch the water. Observe which blobs of wax melt. |
| c) <u>Observe and compare the effect of different materials on melting rate of an ice cube.*</u> | Place an ice cube in each of the following; styrofoam cup, paper cup, tin can, glass beaker, plastic cup. Place each container in a container of boiling H ₂ O. Observe which ice cube melts first, second, third, fourth, fifth. |
| d) <u>Hypothesize and test that the melting rate of an ice cube is affected by the amount of material around it.</u> | Get five ice cubes. Cut newspaper into equal sized pieces. Wrap ice cube #1 with one piece of paper. Follow the same pattern to ice cube #5 and five pieces of paper. After a time compare sizes. Determine who can get an ice cube to melt the fastest, last the longest. |
| e) <u>Compare and record the insulating and conducting qualities of materials.</u> | Pour hot H ₂ O into the following containers that are about the same size: glass beakers, plastic cup, tin can, styrofoam cup, paper cup. Cover the openings with aluminum foil. Measure the temperature of the H ₂ O in each container at three 10 minute intervals. |
| f) <u>Appreciate why certain types of insulation are used in homes.**</u> | Show examples of thermax, styrofoam, fiberglass, wood chips, newspaper, etc. and discuss their use. |

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
		<u>SAFETY</u> Be aware of the hazards of handling fibreglass. It is recommended that asbestos be avoided.
6. Different colours absorb different amounts of heat.	a) <u>Observe</u> that different colours absorb different amounts of heat. b) <u>Discuss</u> how colour helps us dress appropriately for seasons.**	Use five thermometers and five different colours of paper, including black and white. Cover only the bulbs of the thermometers. Leave in direct sunlight. Record temperature at different intervals and graph results using a simple bar graph. Place different squares of coloured paper on a level surface of snow and observe the condition of the snow after several hours.

GRADE THREE

CHANGES IN MATTER AND ENERGY: CHANGES IN MATTER



GRADE THREE

TITLE: CHANGES IN MATTER AND ENERGY: CHANGES IN MATTER

RATIONALE: Through the use of process skills, children will recognize solutions and suspensions and develop an understanding of filtration and sedimentation. Children will develop an awareness of physical and chemical changes and be able to relate these to daily life.

MAIN CONCEPT(S): Matter is made of particles.
Matter can be mixed and separated. Changes that occur are physical or chemical.

- * Refers to problem solving
- ** Refers to STS
- *** Refer to SDS

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	The student should be able to:	
1. Review properties of objects and change from grade one.	a) <u>Identify</u> various properties of objects.	<u>SAFETY</u> Be aware of safety in handling materials.
2. Matter occupies space.	a) <u>Observe</u> that two objects cannot occupy the same space at the same time.	Have a student stand on a square sheet of paper and show that no more students can fit on the sheet.
	b) <u>Predict and test</u> the displacement of different objects.	Predict how many marbles or pennies will fit into a glass full of water. Gently lower each penny into the glass until the water runs over. Have enough pennies on hand.
	c) <u>Observe</u> that solids occupy space in liquids by displacing the liquid.	<u>ENRICHMENT</u> Observe that liquids occupy space in solids by displacing air. Place a sponge in water and observe the air bubbles escaping.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
3. Matter is made up of small parts.	a) <u>Observe</u> similarities between the properties of large and small parts of an object.	Observe sawdust and wood, sand and sandstone, sugar and sugar cubes, ripped paper and a sheet of paper.
4. Particles can distribute themselves throughout a liquid.	a) <u>Identify</u> and <u>infer</u> the presence of sugar in a solution of sugar and water.	
	b) <u>Observe</u> the distribution of a <u>liquid</u> throughout a liquid.**	Add food colouring to water, milk to tea, liquid chocolate to milk.
	c) <u>Infer</u> that solids, when dissolved, have the ability to pass through small openings in paper towelling and coffee filters.	Use the taste test for a salt solution before and after filtering.
	d) <u>Compare</u> the properties of a solution after filtration with the properties of the original solution.	Filter a sugar solution and compare to original solution. Evaporate both sugar solutions and compare residues.
5. Particles can distribute themselves throughout a gas.	a) <u>Observe</u> the formation of condensation and infer the presence of water vapour in the air.	Observe breath on a mirror or cold window. Half fill a shiny can with ice-water and observe the condensation on the lower half of the tin.
	b) <u>Test</u> the effect of different temperatures on the rate of evaporation. <u>Identify</u> variables that affect the rate of evaporation.*	Set identical containers full of water in different areas e.g. on the floor, on a sunny window ledge, over a hot air register, etc. Observe and record the temperature and the level of water over time. (Chart the results.)

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
		<u>ENRICHMENT</u>
		Use a clear 2 L plastic cola bottle and place 10 mL of water into it. Hold a smoldering match over the slightly tilted bottle so that the smoke enters the bottle. Cover with a rubber stopper. Squeeze the bottle repeatedly and observe the formation of a cloud.
	c) <u>Observe</u> by <u>smell</u> and <u>infer</u> the presence, of a substance which passes readily through a membrane.	Put substances in styrofoam cups and cover with Kleenex. infer the identity of the substance by its smell.
	d) <u>Predict</u> and <u>test</u> the ability of various materials to prevent an odour from escaping.*	<u>SAFETY</u> No toxic gases should be used. Use plastic wrap, tin foil, rubber balloons, Kleenex, towelling, etc., to wrap test items such as garlic, onion, coffee.
6. Small particles can be used to build larger pieces of matter.	a) <u>Observe</u> that small particles can be used to form larger pieces of matter.	Observe puzzles, plasticene, lego, particle board, etc. Make no-bake granola bars.
7. A mixture of materials can be separated on the basis of unique properties.	a) <u>Separate</u> mixtures of different solids on the basis of their properties.	Use mixtures to represent all properties, i.e., hardness--nails, peanuts, marshmallows.
	b) <u>Design</u> a method to separate raisins, peanuts, cheerios.*	Separate granola, alphabets, fruit loops, bird seed.

ENRICHMENT

Design a machine to separate solids, i.e., coins, buttons.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	c) <u>Describe</u> other methods of separation.**	Use examples such as grain elevators, gravel crushers, and top soil sifters.
8. Some materials can be separated on the basis of magnetism.	a) <u>Observe</u> and <u>test</u> different reactions of <u>solids</u> (metals) to magnets.	Compare different coins for their magnetic property. Try coins from other countries. Research the content of Canadian coins. Does the date of a coin affect its magnetic property.
9. A mixture of certain solids and liquids can be a solution or a suspension.	a) <u>Observe</u> and <u>compare</u> solutions and suspensions.	Note that materials dissolved in a liquid are usually clear and are solutions, i.e., coffee, cool-aid, tea. Materials distributed in a liquid are usually cloudy and are suspensions, i.e., flour in water, oil in vinegar, mud in water.
	b) <u>Classify</u> mixtures of water and solids as solutions or suspensions.	<u>SAFETY</u> Remind students never to taste unless advised to do so by the teacher.
	c) <u>Record</u> changes over time.	
10. Two ways of separating most solutions and suspensions are filtration and sedimentation. i) filtration	a) <u>Observe</u> and <u>compare</u> filtered mixtures of solutions and suspensions.	Shake a mixture of soil and water. Allow to settle and watch for changes. Allow students to note that there is no change for solutions.

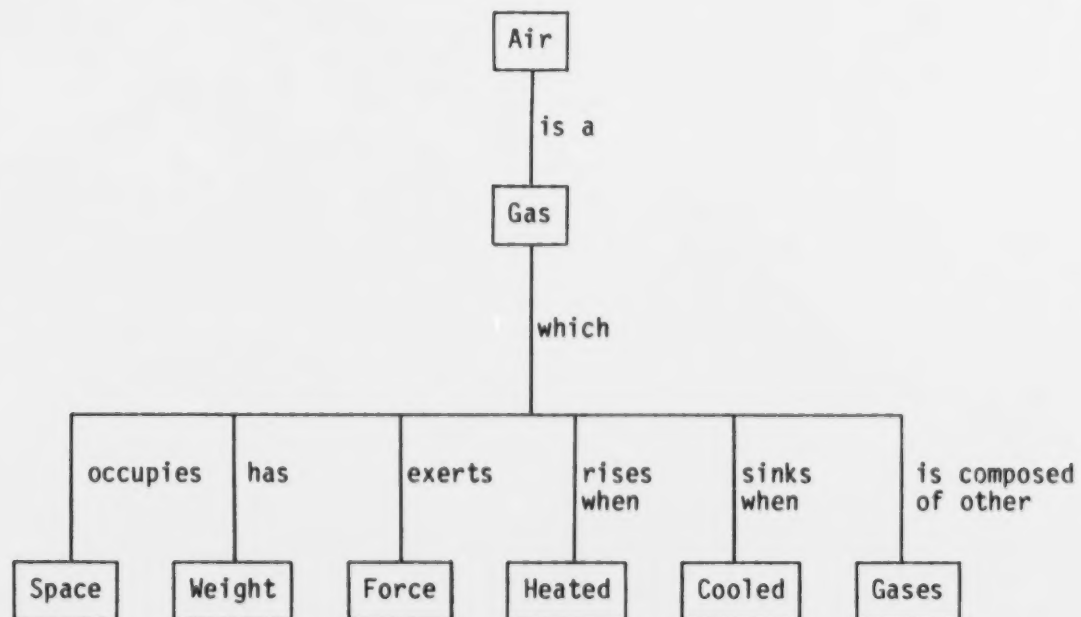
CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
ii) sedimentation	b) <u>Identify</u> and <u>record</u> solids that dissolve readily and cannot be separated by filtration and solids which do not dissolve readily.	<u>ENRICHMENT</u> Design filters to be used for different purposes.
	c) <u>Predict</u> the efficiency and <u>test</u> different filters used to separate solid and liquid mixtures.*	Use a magnifying glass to look at filtered material.
	d) <u>List</u> filters used by man.**	Discuss air filters in cars; filters in coffee makers, furnaces, air masks; door screens, colanders, vegetable steamers.
	e) <u>List</u> filters that are found in nature.**	Discuss nose hairs, fish gills, whale baleen, clouds, ozone layer, and sand as filters.
	a) <u>Observe</u> and <u>record</u> mixtures that leave a sediment.	Observe mixtures from 10 (a). Observe a salad spinner and a clothes dryer.
11. Liquids vary in their specific properties.		<u>ENRICHMENT</u> Do an activity with mystery powders.
	b) <u>Record</u> the length of time needed for the sediment to form.	
	a) <u>Observe</u> some properties of different liquids: transparency, and absorbency.	Use an eye dropper to drop tiny amounts of different liquids onto a paper towel.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	b) <u>Compare</u> and <u>test</u> different <u>liquids</u> on the basis of properties of viscosity and the ability to dissolve sugar.	Compare motor oil, vegetable oil, peanut oil, olive oil, water, vinegar, syrup, molasses, glycerol.
	c) <u>Order</u> liquids on the basis of properties.	Order from heaviest to lightest, thickest to thinnest, in terms of absorbency, viscosity, etc.
	d) <u>Identify</u> and <u>record</u> identity of sample liquids on the basis of evidence.*	Provide groups of students with a plastic vial and containers of oil (vegetable, baby) and water. Place the two liquids into the vial. Is there a difference if they are poured in a different order? What happens when you shake it, then after it stands? Predict which liquids will sink and which will float. Discuss fair tests. (Indicating that all variables must be controlled.)
	e) <u>Observe</u> and <u>describe</u> the mixing of liquids.	
		<u>ENRICHMENT</u>
		Compare the behaviour of water drops on different surfaces. Compare the shapes of different liquids on a specific surface.
		<u>ENRICHMENT</u>
		Design and construct a fair test.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
12. Some changes are physical.	a) <u>Classify</u> and <u>record</u> changes in matter as either permanent or reversible. b) <u>Describe</u> and <u>observe</u> physical changes.**	List permanent changes such as a rubber band being cut, eggs being cooked, peeling of fruit. List reversible changes such as curling of hair, freezing water, etc. Observe a rubber band being stretched; corn popping; soap becoming soap flakes; paper being torn; balloon being inflated; chalk being crushed.

GRADE THREE

CHANGES IN MATTER AND ENERGY: AIR AND AIR PRESSURE



GRADE THREE

TITLE: CHANGES IN MATTER AND ENERGY: AIR AND AIR PRESSURE

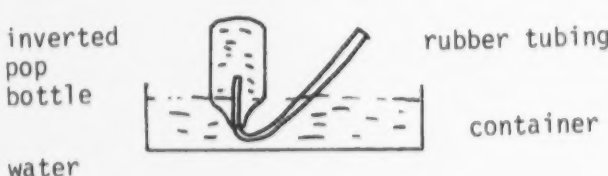
RATIONALE: Through the use of process skills, children will begin to understand air and air pressure and what effects they have in our daily lives.

MAIN CONCEPT(S): Air is a form of matter which has certain properties.

- * Refers to problem solving
- ** Refers to STS
- *** Refers to SDS

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	The student should be able to:	
1. Air is a gas and has distinctive properties.		
i) Air occupies space.	a) <u>Develop</u> a curiosity about natural events, i.e., wind and weather phenomena.	
	b) <u>Infer</u> the presence of air by the resistance it offers.	Put a baggie inside a wide mouth jar. Tape the edge of the baggie to the edge of the jar. Try to pull the baggie out.
	c) <u>Infer</u> that cold air occupies less space than warm air.	Fill a balloon and observe what happens when you put it in cold water and then put it in hot water.
		Place a balloon on the mouth of a flask or bottle. Heat the bottle or flask of air. Observe the balloon inflate. Remove the source of heat. Observe the balloon deflate.

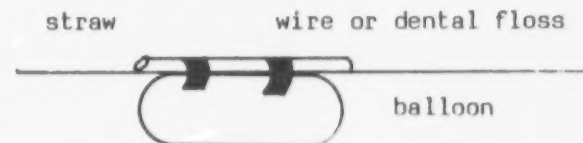
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CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	d) <u>Infer</u> the presence of air by its displacement of water.	Fill a pop bottle with water. Invert it into a large container of water. Blow air through a tube into the pop bottle and observe the air displace the water. 
ii) Air has weight.	a) <u>Infer</u> that air has weight.	Tie a balloon to each end of a balance. Pop one balloon. The other is now heavier and the balance tilts.
iii) Air exerts force.	a) <u>Observe</u> the effects of the <u>force</u> of air.	Take a drink can, add a spoonful of water and boil the water. Invert in a bowl of cold water. <u>SAFETY</u> Use tongs or pot holder to handle can. Take a two liter plastic bottle and fill it with hot water. Dump out the water. Put the lid on and put under cold water. Fill a glass full of H₂O. Place a stiff piece of bristle board over the mouth of the glass. Holding the bristle board in place with one hand, invert the glass of H₂O. Slowly remove your hand holding the bristle board.

CAUTION Hold the glass over an empty dishpan.

- b) Infer that air exerts a force which can change the direction in which an object will move.

Do the balloon on a wire activity.



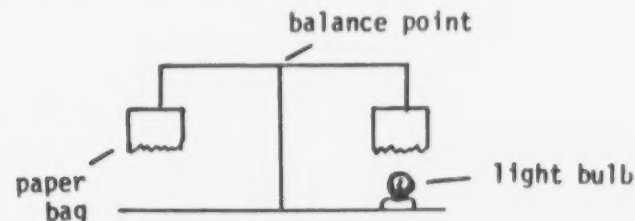
ENRICHMENT

Design and construct a balloon powered vehicle to travel as far as possible.

- iv) Warm air rises and cold air sinks.

- a) Observe that warm air rises and cold air sinks.

Make a bag balance for observing the effects of cold and warm air.



- v) Air is composed of other gases.

- a) Observe water vapour on a surface.

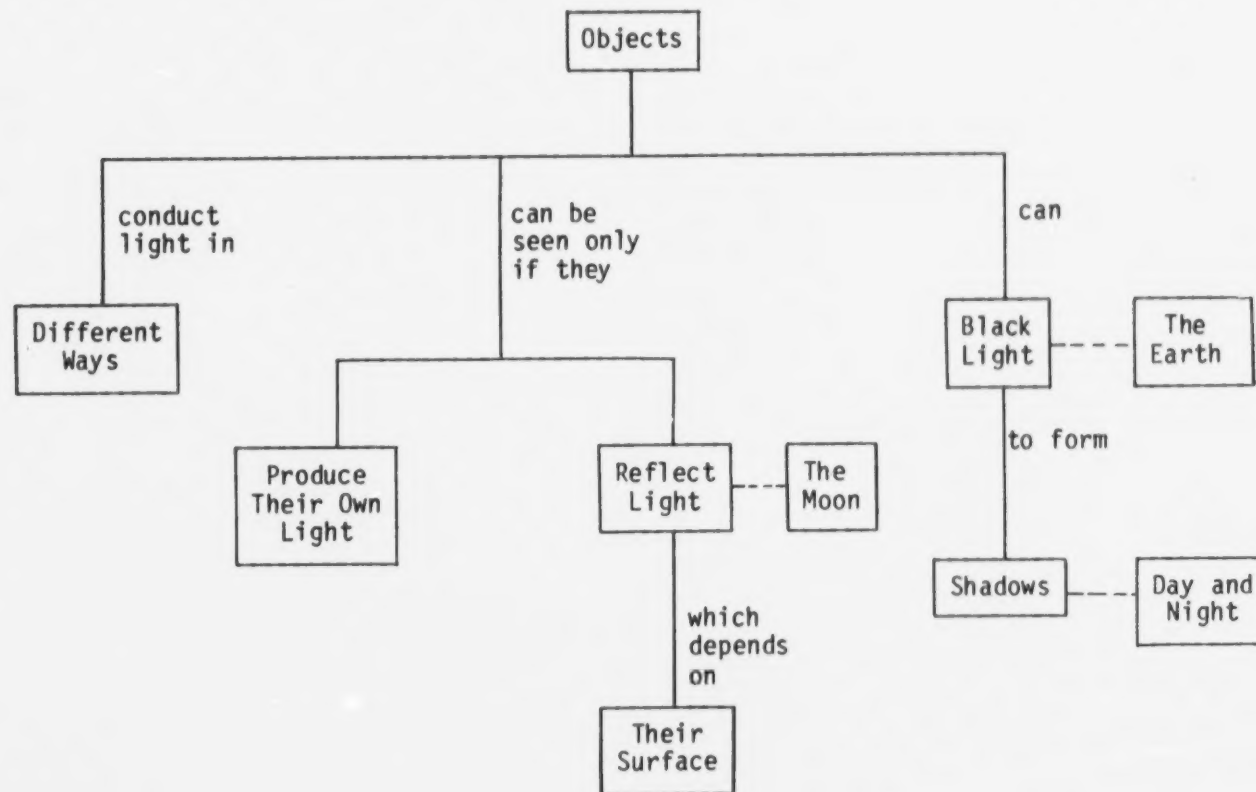
Place a boiling kettle under a tin plate of ice cubes. Observe what happens.

- b) Infer the presence of gaseous water in the breath.

Allow students to breathe on a cold window or mirror. Observe.

GRADE THREE

EARTH, SPACE AND TIME: THE EARTH, SUN AND MOON



GRADE THREE

TITLE: EARTH, SPACE AND TIME: THE EARTH, SUN AND MOON

RATIONALE: Through the use of process skills, children will develop an understanding for the position of the sun, earth and moon.

MAIN CONCEPT(S): The structure of an object affects the transition of light through it. The measurement of time can be determined from the shadows cast by an object.

- * Refers to problem solving
- ** Refers to STS
- *** Refers to SDS

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
The student should be able to:		
1. Different materials conduct light in different ways.	a) <u>Review</u> shadows from grade 2. b) <u>Distinguish</u> among opaque, translucent and transparent; <u>observe</u> the resulting type of shadow.**	Demonstrate opaque, translucent and transparent by placing the following on an overhead projector. (i) piece of black construction paper - opaque (ii) piece of wax paper - translucent (iii) piece of window - transparent glass
2. Objects can be seen only if they produce their own light or reflect light.	a) <u>Observe</u> that the light must be <u>present</u> for an object to be seen.	Cut a hole in the top of a shoe box. Poke a small peephole in one end. Place an object in the box. Observe the object through the peephole. Cover the hole in the box and note that the object cannot be seen.
3. Some surfaces reflect light better than others.	a) <u>Observe</u> and <u>compare</u> two different reflecting surfaces.	Use the same box as in 2(a) above. At the end opposite the peephole, put different types of material such as a mirror, white paper, black paper, etc., and make observations.

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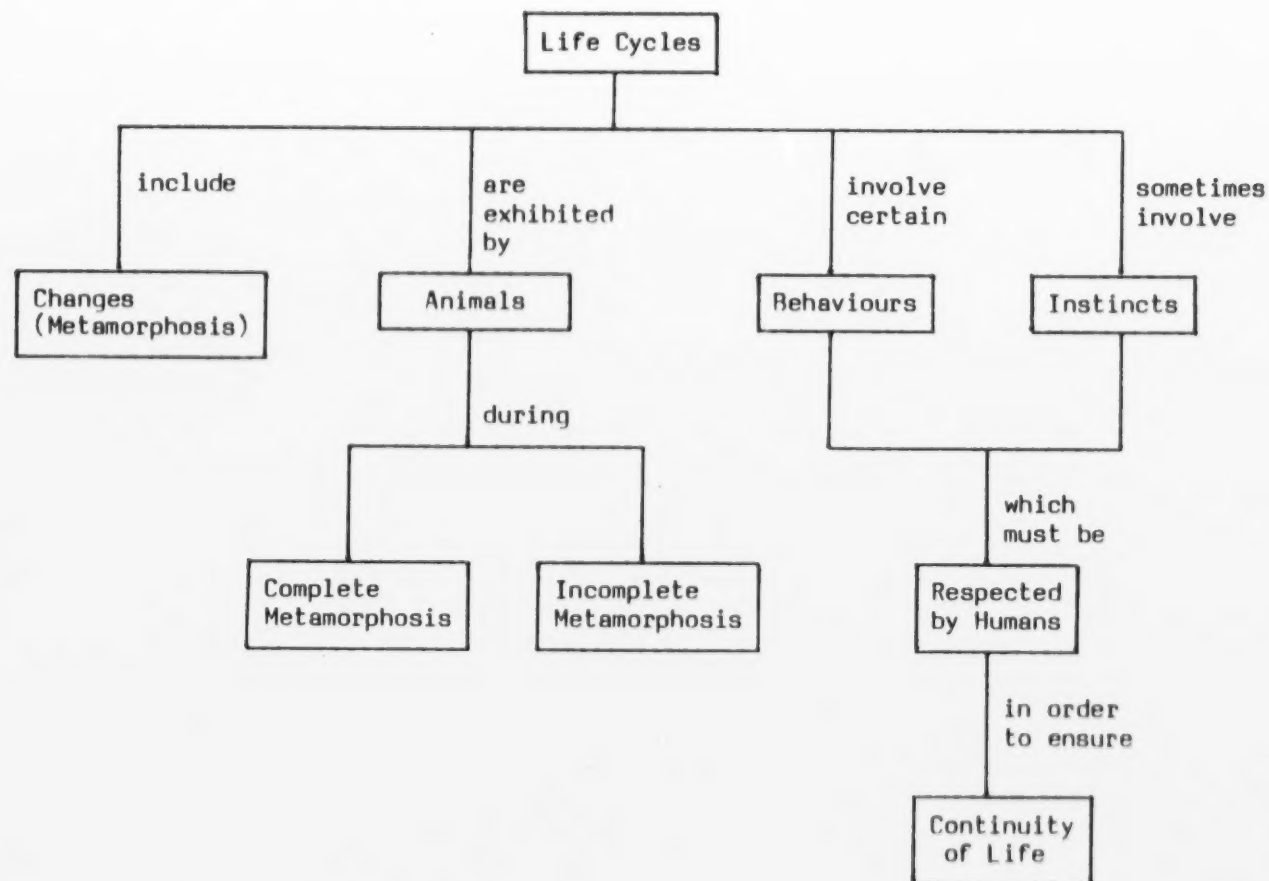
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CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	b) <u>Classify</u> different materials in respect to reflective qualities.	<u>EXTENSION</u> Discover why windows are made either transparent or translucent. Compare the benefits and drawbacks of both types.
	c) <u>List</u> uses of reflective materials.**	Examine or discuss mirrors, space shuttle tiles, bicycle reflectors, car headlights, patrol belts, Halloween safety, etc.
4. Sunlight can be blocked by clouds and by objects that form shadows on the earth.	a) <u>Observe</u> and <u>record</u> the shadows caused by objects and clouds.	Observe and record shadows on the playground.
	b) <u>Infer</u> the location of the sun by observing shadows.	
5. As a given point on the Earth's surface faces away from the sun, night occurs. As a given point on the Earth's surface turns and faces the sun, daytime occurs.	a) <u>Simulate</u> earth-sun relationship.	Construct a model of <u>or</u> act out the earth-sun relationship.
	b) <u>Infer</u> that the sun <u>appears</u> to move across the sky by observing the shadows of a stationary object.	Construct a model to scale. Use a soccer pole on the playground as your stationary object. Observe and measure its shadow at: 9:00 a.m. 2:00 p.m. 10:30 a.m. 3:30 p.m. 12:00 noon
	c) <u>Observe</u> that night and day occur once in a 24 hour period.	<u>SAFETY</u> Caution students to never look directly at the sun.
	d) <u>Observe</u> and <u>record</u> sunset and sunrise over a period of time.	<u>ENRICHMENT</u> Explain why the time at which sunrise and sunset occur varies during the year.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
6. From a given point on the earth's surface the moon seems to appear in the east, move across the sky, and disappear in the west as the earth rotates.	a) <u>Simulate</u> sun-earth-moon relationship.	Construct a model of or act out the sun-moon-earth relationship.
	b) <u>Observe</u> that the moon appears to move across the sky each night.	<u>ENRICHMENT</u> Observe and record the position of the moon during a period of time and chart its path.
7. The moon appears to change shape during the month because of its position in relation to the earth's shadow.	a) <u>Observe</u> and <u>record</u> the phases of the moon.	Record the moon's shape over a period of time. (This record should be kept for at least a month or more).

GRADE THREE

INTERDEPENDENCY AND INTERACTION AMONG ORGANISMS: LIFE CYCLES



GRADE THREE

TITLE: INTERDEPENDENCY AND INTERACTION AMONG ORGANISMS: LIFE CYCLES

RATIONALE: Through the use of basic processes, children will develop an awareness that animals change and grow gradually throughout their life cycle.

MAIN CONCEPT(S): Living organisms exhibit life cycles. There are similarities and differences between these life cycles. Living things exhibit certain behaviours during their life cycles.

- *Refers to problem solving
- **Refers to SIS
- ***Refers to SDS

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	The student should be able to:	
1. A life cycle includes the sequential changes, in order, in the life of a living thing.	a) <u>List</u> the different stages that an organism goes through during its lifetime.	Observe the growth of an organism through its life cycle such as a frog or a meal worm.
	b) <u>Define</u> metamorphosis.	
2. Animals exhibit life cycles.		
i) Some animals exhibit a complete metamorphosis.	a) <u>Define</u> and <u>observe</u> a complete metamorphosis.	Agree on a definition that complete metamorphosis is a series of four stages. i.e. egg, larva, pupa and adult. Examples of insects which undergo complete metamorphosis are: butterfly, mealworm, ant, bee, fly, and mosquito.
	b) <u>Observe</u> that many young animals change completely from their parents.	

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CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
ii) Some exhibit an incomplete metamorphosis (3-stage life cycle).	a) <u>Define</u> incomplete metamorphosis. b) <u>List</u> animals that exhibit an Incomplete metamorphosis. c) <u>Infer</u> that these young look much like their parents. d) <u>Observe</u> an incomplete metamorphosis.	Have students observe incomplete metamorphosis. Infer that not all organisms go through the same changes. Agree on a definition that incomplete metamorphosis does not include all of the four distinct stages in an insect's life history. e.g. The grasshopper lacks the pupa stage in its life history. Have students develop a list which includes the frog.
iii) Animals can be classified according to their metamorphosis.	a) <u>Compare</u> incomplete and complete metamorphoses by their similarities and differences. b) <u>Classify</u> animals into incomplete and complete metamorphoses.	Study an animal that exhibits complete metamorphosis.
3. Living things exhibit certain behaviours during their life cycles.	a) <u>Define</u> behaviour. b) <u>List</u> some behaviour of animals.**	Discuss with students to develop an appropriate definition for behaviour. The list should include such things as squirrels gather acorns, birds sit on eggs, birds migrate, frogs croak to find mate, flocking, herding.

CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
	c) <u>Observe</u> how the behaviours of animals change in relation to heat, light, and water.	<u>Research</u> why crickets chirp faster when the air is warm. <u>Observe</u> beetles when half are placed in a warmed cup and half in cooled cup. <u>Infer</u> what you do if you place your hand on a warm pan. <u>SAFETY</u> Take care that the cup is not too hot. Cover half of a pie plate with foil to create a darkened area. Place meal worms (earthworms may be used) in the uncovered part and <u>observe</u> where the worms go. Have the students design a test to see if an earthworm can find its way home. For example, place a wet paper towel and a dry paper towel in a foil pie plate so that they do not touch each other. Place three earthworms on each towel and observe their reaction. Have the students design a test to find out why earthworms come out on the road after a heavy rain. For example, put soil and six earthworms in a foil pie plate. Add water to the soil. Collect data and record.
4. An instinct is the ability to do something without having to learn how.	a) <u>List</u> instincts that animals have. b) <u>Infer</u> that humans do not have the instinct to build nests.*	Some examples could be birds sit on eggs, barking guard dog, spiders spin webs, birds build nests. <u>Design</u> a nest and compare to an bird's nest. List similarities and differences.

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CONCEPTUAL STRUCTURE	OBJECTIVES	ACTIVITIES, REFERENCES
		<u>Design</u> a small environment for worms and beetles that will accommodate each animal's behaviour.
	c) <u>Classify</u> animals by their <u>instincts</u> to; i) build things; ii) guard their home; iii) migrate; iv) live in groups; v) prepare for winter; vi) reproduce.	Have students develop a list of animals in each case. For example, the instinct to reproduce may include salmon travelling upstream to their spawning grounds.
5. Humans must respect these behaviour and instincts to allow for the continuity of life cycles.	a) <u>Recognize</u> that animals have <u>special</u> behaviour that must be respected by humans. b) Appreciate the adaptive value of some animal behaviour.	For example, salmon--over-fishing when spawning; geese--hunting over limit when migrating. Hunting regulations.

RESPONSE QUESTIONNAIRE FOR K-9 SCIENCE PROGRAM OF STUDIES

Please return this questionnaire by January 15, 1992 to the:

Science Consultant
Curriculum Services
Manitoba Education and Training
411-1181 Portage Avenue
Winnipeg, Manitoba R3G 0T3

Please respond to each question in the space provided. (Attach extra sheets if more space is required). Use the page references when making specific comments.

1. Does the guide provide you with sufficient information as to nature and scope of the science program?

2. Are you able to adequately cover the stated objectives within the available class time?

3. Are your students capable of achieving the objectives listed in the unit(s)?

4. Is there sufficient variety in the activities to allow all students to take part in the program?

5. Which activities are too simple or too difficult for the intended grade level?

6. Which activities do not seem to work well?

7. Which activities require clearer directions?

8. Are there sufficient material resources in your school to enable you to adequately teach the program?

9. Is there difficulty in obtaining science materials in order to carry out the activities?

10. Do the students enjoy or appreciate the program?

11. What are some specific features of the program with which you are pleased?

12. Within the framework of the revised program, please make suggestions which, in your opinion, may result in significant improvements.

NAME: _____ SCHOOL: _____

GRADE: _____ PHONE: _____

THANK YOU FOR YOUR ASSISTANCE.